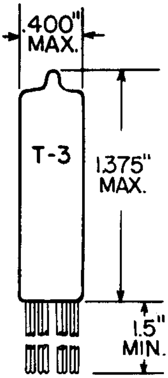
TUNG-SOL

TWIN TRIODE

SUBMINIATURE TYPE

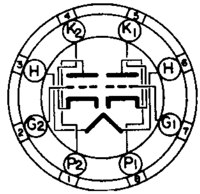


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE — 8
FLEXIBLE LEADS
8DG

THE 6021 IS A RUGGEDIZED MEDIUM MU TWIN TRIODE OF THE LIGHT LEAD, BUTTON, SUBMINIATURE CONSTRUCTION. THE TUBE MAY BE USED AT FREQUENCIES IN THE UHF REGION, PERMITTING APPLICATIONS SUCH AS UHF AND VHF OSCILLATORS AND MIXERS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SEPCIFICATION, THE 6021 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES — EACH SECTION

	WITH SHIELD*	WITHOUT SHIELD	
GRID TO PLATE (RATED)	1.4	1.5	μμf
MAXIMUM	---	1.7	μμf
MINIMUM	---	1.3	μμf
INPUT (RATED)	2.1	2.4	μμf
MAXIMUM	---	2.8	μμf
MINIMUM	---	2.0	μμf
OUTPUT (SECTION #1) (RATED)	1.3	0.28	μμf
MAXIMUM	---	0.33	μμf
MINIMUM	---	0.23	μμf
OUTPUT (SECTION #2) (RATED)	1.4	0.32	μμf
MAXIMUM	---	0.39	μμf
MINIMUM	---	0.25	μμf
MAXIMUM GRID TO GRID (RATED)	0.011	0.013	μμf
MAXIMUM PLATE TO PLATE (RATED)	0.33	0.52	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE	±200	VOLTS
MAXIMUM GRID RESISTANCE (EACH SECTION)	1.1	MEGOHM
MAXIMUM DC PLATE CURRENT (EACH SECTION)	22	mA

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RATINGS – CONT'D.

ABSOLUTE MAXIMUM VALUES

MAXIMUM DC GRID CURRENT (EACH SECTION)	5.5	mA
MAXIMUM PLATE DISSIPATION (EACH SECTION)	0.7	WATT
MAXIMUM BULB TEMPERATURE	220	°C
MAXIMUM ALTITUDE [A]	60 000	FEET
LIFE EXPECTANCY:		
30°C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
DC PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	6.5	Ma
TRANSCONDUCTANCE	5 400	μMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE FOR 10μa PLATE CURRENT	-6.5	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 100Vdc, E_c = 0 Vdc, Rk/k = 150 OHMS
EXCEPT AS MODIFIED BELOW

	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	500 HOUR LIFE TEST INDIVIDUAL MIN.	500 HOUR LIFE TEST INDIVIDUAL MAX.	
HEATER CURRENT	280	320	288	312	276	328	mA
HEATER-CATHODE LEAKAGE [B] (E_{hk}=±100Vdc)	---	±5.0	---	---	---	±10	μAdc
GRID CURRENT (E_b= 150Vdc, R_k=300, R_{g1}=1.0 MEG.)	0	-0.3	---	---	0	-0.9	μAdc
PLATE CURRENT (1)	4.5	8.5	5.6	7.3	---	---	mAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	1.6	---	---	---	---	mAdc
PLATE CURRENT (2) (E_c=6.5Vdc, R_k=0)	---	100	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	4450	6350	5000	5800	---	---	μMHOS
CHANGE IN INDIVIDUAL TUBES	---	---	---	---	---	25	PERCENT
AVERAGE CHANGE	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES [C] g-ALL	100	---	---	---	50	---	MEGOHMS
p-ALL	100	---	---	---	50	---	MEGOHMS
Δ TRANSCONDUCTANCE (E_f = 5.7V)	---	15	---	---	---	15	PERCENT
GRID EMISSION [D] (E_f=7.5V, E_c=-7.5Vdc E_b=150Vdc, R_k=0, R_p=1.0MEG)	---	-0.5	---	---	---	---	μAdc
PULSE EMISSION [E] (E_f=6.0V, e PULSE=50V, tp=25 usec, prr=200pps)	300	---	---	---	---	---	ma
AMPLIFICATION FACTOR [F]	30	40	---	---	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
AF NOISE [GH] (E_{sig}=65mVac, R_g=0.1 meg., R_p=.01 meg., R_k=75, C_k=1000μf)	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN [J] (PRESSURE =55±5mm Hg., VOLTAGE =300Vac)	---	---	

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SPECIAL REQUIREMENTS – CONT'D.

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [K] (NO VOLTAGES, POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
LOW FREQUENCY VIBRATION [MG] (R_p = 10,000, C_k=1,000 µf, F=40cps, G=15)	---	50	mVac
SUBMINIATURE LEAD FATIGUE [N]	4	---	ARCS
SHOCK [P] (HAMMER ANGLE = 30°, E_{hk}=+100Vdc, R_g=0.1meg.)	---	---	
VIBRATIONAL FATIGUE [R] (G = 2.5; FIXED FREQUENCY; F=25min. 60 max.)			
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	200	mVac
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	20	µAdc
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
GLASS STRAIN [S]	---	---	
1 HOUR STABILITY LIFE TEST [G] (E_{h1c}=+200Vdc, R_{g1g}=1.0 meg., TA=ROOM)	---	---	
STABILITY LIFE TEST END POINTS			
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	15	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (STABILITY LIFE TEST CONDITIONS OR EQUIVALENT TA=ROOM)	---	---	
SURVIVAL RATE LIFE TEST END POINTS			
CONTINUITY AND SHORTS (INOPERATIVES)	---	---	
TRANSCONDUCTANCE (1)	---	4 000	µMHOS
HEATER CYCLING LIFE TEST [U] (E_f=7.0V, 1 min. on, 4 min. off, E_{hk}=140Vac, E_c= E_b=0)	---	---	
INTERMITTENT LIFE TEST (STABILITY LIFE TEST CONDITIONS, BULB TEMP = 220°C)	---	---	

NOTES

[A] IF ALTITUDE RATING IS EXCEEDED, REDUCTION OF INSTANTANEOUS VOLTAGES (Ef EXCLUDED) MAYBE REQUIRED.

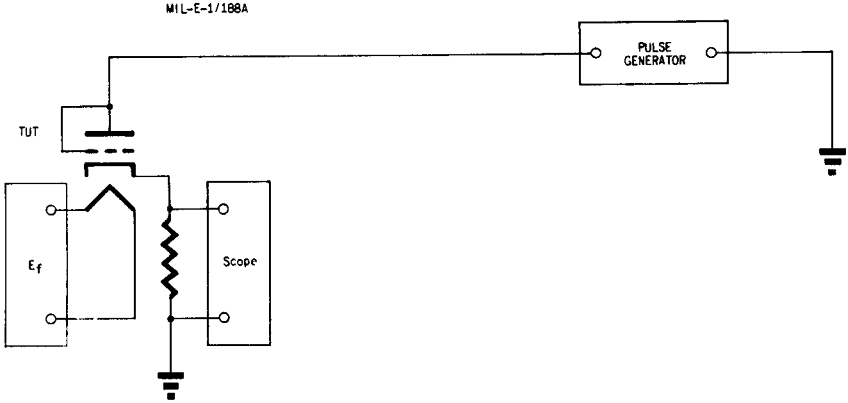
[B] SEE MIL-E-1C 4.10.15

[C] SEE MIL-E-1C 4.8.2

[D] PRIOR TO THIS TEST PRE-HEAT TUBES FOR 5 MINUTES WITH BOTH SECTIONS OPERATING SEPARATELY AT CONDITIONS LISTED BELOW. TEST IMMEDIATELY AFTER PRE-HEATING. (E_f=7.5V, E_c=0Vdc, E_b=150 Vdc, R_k=300 OHMS, R_g=1.0 MEG).

[E] THE PULSE IS ESSENTIALLY A SQUARE WAVE WITH 1.0 USEC RISE TIME AND 0.8 USEC FALL. THE PULSE SHALL BE APPLIED TO PLATE AND GRID TIED TOGETHER. PULSE EMISSION SHALL BE MEASURED IN TERMS OF VOLTAGE DEVELOPED ACROSS A 1.0 OHM RESISTOR IN THE CATHODE CIRCUIT. TEST LIMIT AS MEASURED BY THE LEADING EDGE OF A CALIBRATED TRACE. THE AMPLITUDE OF THE TRAILING EDGE OF WHICH SHALL NOT VARY BY MORE THAN 20% FROM THE VALUE OF THE LEADING EDGE. TEST EACH UNIT SEPARATELY.

MIL-E-1/188A



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NOTES - CONT'D.

[F] SEE MIL-E-1C 4.10.11.1

[G] TIE 1K TO 2K, 1g TO 2g, AND 1p TO 2p.

[H] SEE MIL-E-1C 4.10.3.2

[J] THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

[K] SEE MIL-E-1C 4.9.20.3

[M] SEE MIL-E-1C 4.9.19.1

[N] SEE MIL-E-1C 4.9.5.3

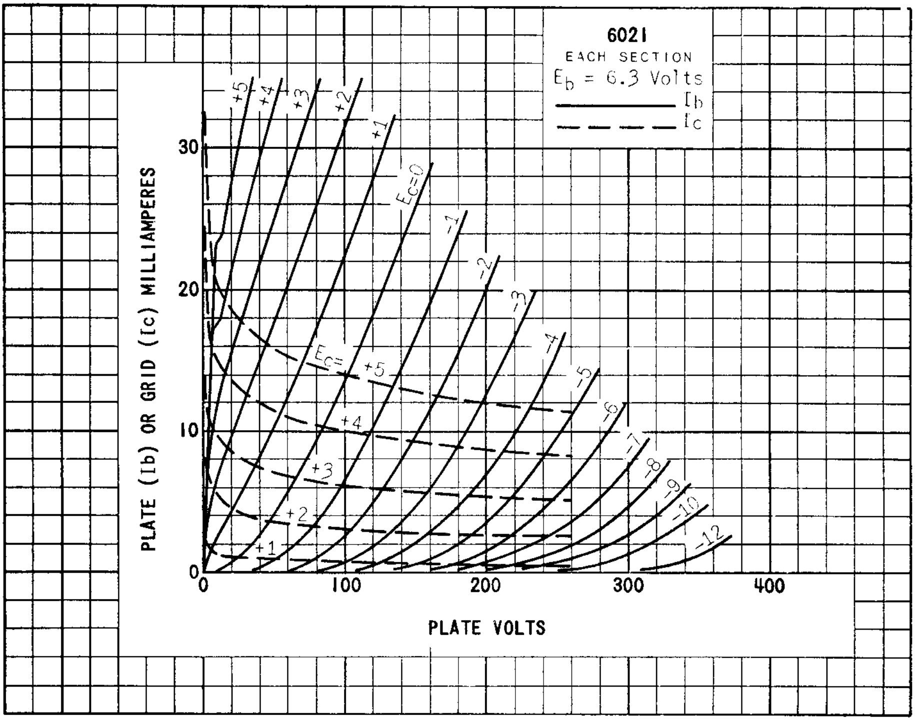
[P] SEE MIL-E-1C 4.9.20.5

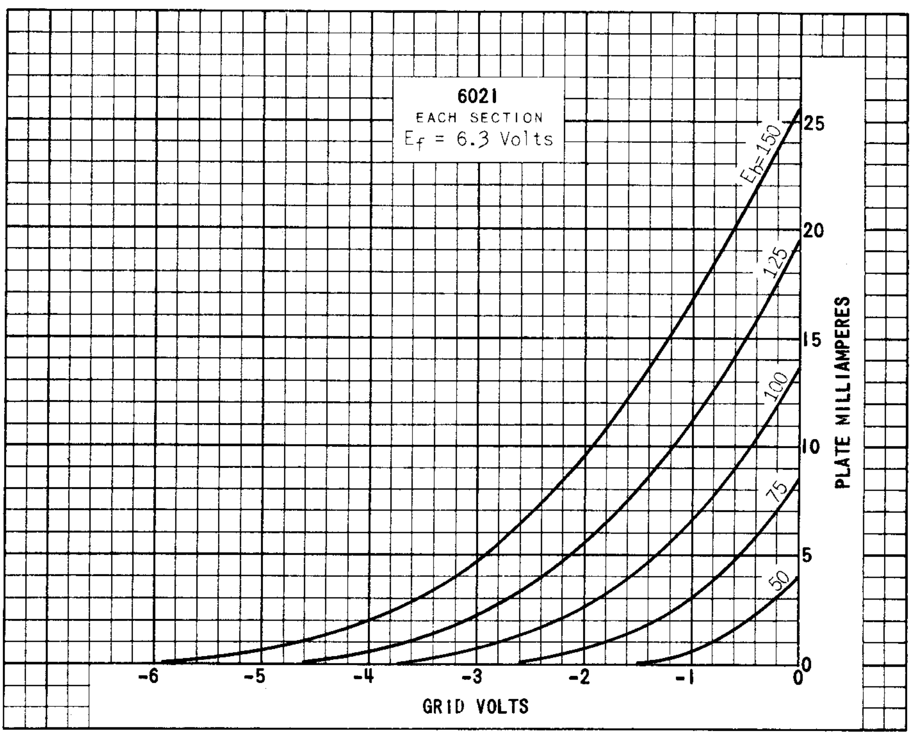
[R] SEE MIL-E-1C 4.9.20.6

[S] ALL TUBES SHALL HAVE BEEN SEALED A MINIMUM OF 48 HOURS PRIOR TO CONDUCTING THIS TEST. TUBES SHALL BE AT ROOM TEMPERATURE. ENTIRE TUBE SHALL BE IMMERSED IN WATER NOT LESS THAN 85° C FOR 15 SECONDS AND IMMEDIATELY THEREAFTER IMMERSED IN ICE WATER NOT MORE THAN 50° C FOR 5 SECONDS. TUBES SHALL BE PLACED IN WATER SO THAT NO CONTACT IS MADE WITH THE CONTAINING VESSEL NOR EACH OTHER. TUBES SHALL THEN BE REMOVED AND ALLOWED TO COOL AT ROOM TEMPERATURE ON A WOODEN SURFACE. THE TUBES SHALL BE ALLOWED TO COOL FOR 48 HOURS AND THEN BE INSPECTED FOR EVIDENCE OF AIR LEAKS.

[U] THE REGULATION OF THE HEATER VOLTAGE SHALL NOT BE MORE THAN 3.0 PERCENT.

* WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE OF SECTION UNDER TEST.


6021
EACH SECTION
E_b = 6.3 Volts
I_b
I_c
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
+5
+4
+3
+2
+1
Ec=0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-12
Ec=
+5
+4
+3
+2
+1


6021
EACH SECTION
E_f = 6.3 Volts
Eb=150
125
100
75
50
PLATE MILLIAMPERES
25
20
15
10
5
0
-6
-5
-4
-3
-2
-1
0
GRID VOLTS

6021
PREMIUM TUBE